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**Citation for published version:**

Gangopadhyay, D & Bhopal, R 2020, 'Psychosocial factors in relation to coronary heart disease in South Asians: a systematic review', *International Medicine*, vol. 2, no. 2, pp. 125-143.  
<https://doi.org/10.5455/im.56710>

**Digital Object Identifier (DOI):**

[10.5455/im.56710](https://doi.org/10.5455/im.56710)

**Link:**

[Link to publication record in Edinburgh Research Explorer](#)

**Document Version:**

Publisher's PDF, also known as Version of record

**Published In:**

International Medicine

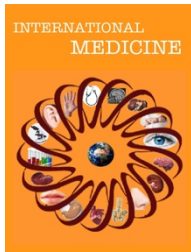
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## International Medicine

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### Review Article

# Psychosocial factors in relation to coronary heart disease in South Asians: a systematic review

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Received: 12 July 2019 / Accepted: 12 December 2019

### Abstract

**Background:** People of South Asia descent in the UK have high coronary heart disease (CHD) risk. Psychosocial factors affect the risk of CHD, independent of ethnicity. Factors such as stress, depression and anxiety are postulated to be predictors of heart disease. The objectives of this review were to systematically review quantitative research on psychosocial factors and CHD in South Asians in Europe and North America to answer the question: What is the relation between psychosocial factors and CHD in South Asians residing in Europe and North America?

**Methods:** A systematic literature review was conducted according to the recommendations of the Centre for Reviews and Dissemination and the PRISMA guidelines. Electronic databases were searched using relevant terms and data were extracted into data extraction forms. The quality assessment criteria were adapted from the National Institute for Health and Clinical Excellence (NICE) guidance 2009. A narrative review was planned.

**Results:** Five cross-sectional studies and their associated eight papers were included. The studies varied with reference to the age of samples, psychosocial factors and in reporting. For depression, four studies showed increased levels in South Asian population compared to the White population. Two studies reported low optimism present in South Asians compared to the general population. Four out of five studies showed lower social support in South Asian men in comparison to the general population. One study found that South Asians had low control and high social support at work compared to the White population. One study showed no differences in work strain.

**Conclusions:** The evidence was limited but indicated psychosocial risk factors were commoner in South Asians compared to the general population. New, large scale, especially prospective studies should explore this.

**Keywords:** Asians, ethnicity, coronary disease, psychosocial factors

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DOI: 10.5455/im.56710

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## Introduction

United Kingdom (UK) based South Asians whose ancestry is in the countries of the Indian sub-continent, including India, Pakistan, Bangladesh [1] have a higher risk of coronary heart disease (CHD) compared to the general population [2]. In North America, South Asians also have a high prevalence of premature atherosclerotic cardiovascular diseases [3]. The causes of this are still under debate. Conventional risk factors like diabetes, hypertension, hyperlipidemia, insulin resistance or metabolic syndrome fail to explain their comparatively high risk [4].

Psychosocial factors including stress, depression [5], chronic work stress [6], high demands at work, low job control [7], social support and personality traits are associated with the risk and progression of CHD [8-11]. The INTERHEART study established that the psychosocial index is a strong independent variable of acute myocardial infarction independent of geographical position or ethnicity of the participants [12] and showed that native South Asians had high levels of unfavorable psychosocial factors [13].

Fox and Shapiro suggested that stress could increase the occurrence of CHD in UK South Asians [14]. Previous reviews on psychosocial factors and CHD have not focused on South Asians [7,15,16]. We systematically reviewed quantitative research on the relation between psychosocial factors and CHD in South Asian adults residing in Europe and North America. These places were chosen as there has been a large migration from South Asia to these areas [17] and there has been much research on the risk factors for ischemic heart disease (IHD) there.

We had one research question: What is the relation between psychosocial factors and CHD in South Asians residing in Europe and North America?

## Methods

### Search strategy

The following databases were first searched from inception to August 2016:

- MEDLINE (from 1946)
- EMBASE (from 1947)
- PsychINFO (from 1806)
- Web of Science (from 1900)
- Google Scholar
- ASSIA (from 1987)

A repeat search was conducted on the above databases in April 2018. The search was conducted looking for free text terms and associated MeSH terms e.g. 'South Asian\$', 'Indian\$', 'Pakistani\$', 'Bangladeshi\$', 'Srilankan\$', psychosocial factor\$, stress, job strain, hostility, depression, anxiety, racism, social isolation, coronary heart disease, ischemic heart disease, myocardial infarction and stud\$. The search results were then combined with Boolean operators to refine the results to ensure the precision and sensitivity of the searches [18]. Grey literature was searched in the Open Grey database.

The search strategy for EMBASE is shown below as an example. The search strategy in all databases is included in Table 1.

The following search terms were used for searching the population:

1. South Asia/ or Asian/ or ethnic group/
2. South Asian\$.mp.
3. Bangladesh/
4. Bangladeshi\*.mp.
5. Indian/ or Asian/
6. Pakistan/ or South Asia/
7. Pakistani\*.mp.
8. Srilankan\*.mp.
9. Nepalese\*.mp.
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. limit 10 to (adult <18 to 64 years> or aged <65+ years>)

The following search terms were used for searching the outcome:

12. ischemic heart disease/ep, et [Epidemiology, Etiology]
13. coronary artery disease/ or vascular disease/

14. exp heart infarction/ep, et [Epidemiology, Etiology]
15. exp cardiovascular disease/
16. 12 or 13 or 14 or 15
17. coronary heart disease.mp.

The following search terms were used for searching the exposure/ risk factors:

18. psychosocial factor\*.mp.
19. exp "mixed anxiety and depression"/
20. bipolar depression/ or atypical depression/ or major depression/ or endogenous depression/ or long-term depression/ or exp depression/
21. mental stress/ or job stress/ or stress/
22. (work or job) adj2 (stress\* or strain).mp.
23. anxiety/ or anxiety neurosis/ or anxiety disorder/
24. exp social isolation/
25. racism/
26. exp hostility/
27. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
28. job strain.mp.
29. 27 or 28
30. 17 or 29

This search was to combine the population, exposure /risk factors and outcome factors or commonly called PIO

31. 11 and 17 and 30

The above search yielded 533 results.

**Table 1.** Detailed search strategy

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#### EMBASE

1. South Asia/ or Asian/ or ethnic group/
2. South Asian\$.mp.
3. Bangladesh/
4. Bangladeshi\*.mp.
5. Indian/ or Asian/
6. Pakistan/ or South Asia/
7. Pakistani\*.mp.
8. Srilankan\*.mp.
9. Nepalese\*.mp.
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. limit 10 to (adult <18 to 64 years> or aged <65+ years>)
12. ischemic heart disease/ep, et [Epidemiology, Etiology]
13. coronary artery disease/ or vascular disease/
14. exp heart infarction/ep, et [Epidemiology, Etiology]
15. exp cardiovascular disease/
16. 12 or 13 or 14 or 15
17. coronary heart disease.mp.
18. psychosocial factor\*.mp.
19. exp "mixed anxiety and depression"/
20. bipolar depression/ or atypical depression/ or major depression/ or endogenous depression/ or long-term depression/ or exp depression/
21. mental stress/ or job stress/ or stress/
22. (work or job) adj2 (stress\* or strain).mp.
23. anxiety/ or anxiety neurosis/ or anxiety disorder/

24. exp social isolation/
25. racism/
26. exp hostility/
27. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
28. job strain.mp.
29. 27 or 28
30. 17 or 29
31. 11 and 17 and 30

The above search yielded 533 results.

#### MEDLINE

1. Asian Continental Ancestry Group/
2. South Asian\$.mp.
3. Indian\$.mp.
4. exp Bangladesh/
5. Bangladeshi\$.mp.
6. Nepal/
7. Nepalese.mp.
8. exp India/
9. India.mp. or India/
10. Srilankan\$.mp. or Sri Lanka/
11. Pakistan/
12. Pakistani\$.mp.
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
14. limit 13 to ("young adult and adult (19-24 and 19-44)" or "middle-aged (45 plus years)" or "all aged (65 and over)")
15. psychosocial factor\$.mp.
16. Stress, Psychological/ or job strain.mp.
17. work strain.mp.
18. Depression/
19. depressive disorder/ or depressive disorder, major/ or depressive disorder, treatment-resistant/
20. Anxiety Disorders/
21. Anxiety/ or anxiety.mp.
22. racism.mp. or Racism/
23. Social Isolation/
24. social isolation.mp.
25. stress.mp. or Stress, Psychological/
26. 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27. coronary heart disease.mp.
28. cardiac.mp.
29. cardiovascular diseases/ or vascular diseases/
30. myocardial ischemia/ or acute coronary syndrome/ or angina pectoris/ or coronary disease/ or myocardial infarction/
31. coronary artery disease.mp. or exp Coronary Artery Disease/
32. ischemic heart disease.mp.
33. exp Stroke/ or stroke.mp.
34. cerebrovascular.mp.
35. 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34
36. 13 and 26 and 35

Results = 329

ASSIA (Applied Social Sciences Index and Abstracts)

(coronary heart disease) OR (coronary arterial disease OR cardiovascular disease) AND (psychosocial factor OR psychosocial risk factors) OR (psychosocial work factors OR depression) OR (anxiety OR social isolation) OR (stress OR strain) AND (south Asian OR south Asians in America) OR (south Asians in Britain OR south Asians in Canada) OR (south Asians migration)

Results = 3938

#### PsychINFO

1. exp Acculturation/ or exp South Asian Cultural Groups/ or exp Immigration/ or exp Cross-Cultural Differences/
2. south Asian\*.mp.
3. exp Minority Groups/ or Indian\*.mp.
4. Pakistani\*.mp.
5. Srilankan\*.mp.
6. Bangladeshi\*.mp.
7. Nepalese\*.mp.
8. 1 or 2 or 3 or 4 or 5 or 6 or 7
9. limit 8 to (320 young adulthood or 340 thirties or 360 middle age or "380 aged " or "390 very old ")
10. coronary heart disease.mp.
11. cardiovascular disorders/ or cerebrovascular disorders/
12. exp Heart Disorders/ or exp Myocardial Infarctions/ or coronary artery disease.mp.
13. cardiac.mp.
14. cardiac disorder.mp.
15. 10 or 11 or 12 or 13 or 14
16. Psychosocial Factors/ or Health Behavior/ or Risk Factors/ or exp Stress/ or psychosocial factor\*.mp.
17. depression.mp. or Reactive Depression/ or Treatment-Resistant Depression/ or exp Major Depression/
18. Anxiety Disorders/ or Anxiety/ or anxiety.mp.
19. work strain.mp.
20. exp Occupational Stress/ or job strain.mp.
21. social isolation.mp. or Social Isolation/
22. racism/ or "race and ethnic discrimination"/ or social discrimination/
23. 16 or 17 or 18 or 19 or 20 or 21 or 22
24. 9 and 15 and 23

Results=70

#### Web of Knowledge

Topic= (south Asians OR India\* OR Pakistan\* OR Bangladeshi\* OR Nepal\* OR SriLanka\*) AND Topic= (psychosocial factors OR depression OR anxiety OR social isolation OR work stress OR racism) AND Topic= (Coronary Heart Disease OR Cardiovascular Disease)

Timespan=All years.

Search language=Auto

Results= 266

Total results retrieved: 5136

#### Inclusion and exclusion criteria of papers

Cross-sectional, cohort and case-control studies were eligible. Language restrictions were not imposed. Papers published in peer-reviewed journals, grey literature and brief reports were included. The review included papers that published data on stress, anxiety, social isolation, racism, job strain, hostility, depression, stress at work and racial discrimination in relation to coronary heart disease, myocardial infarction and ischemic heart disease on adult South Asians resident in Europe and North America.

Randomized controlled trials, qualitative studies, studies on children and adolescents, those from outside Europe and North America and abstracts were excluded.

## Handling and selection of references

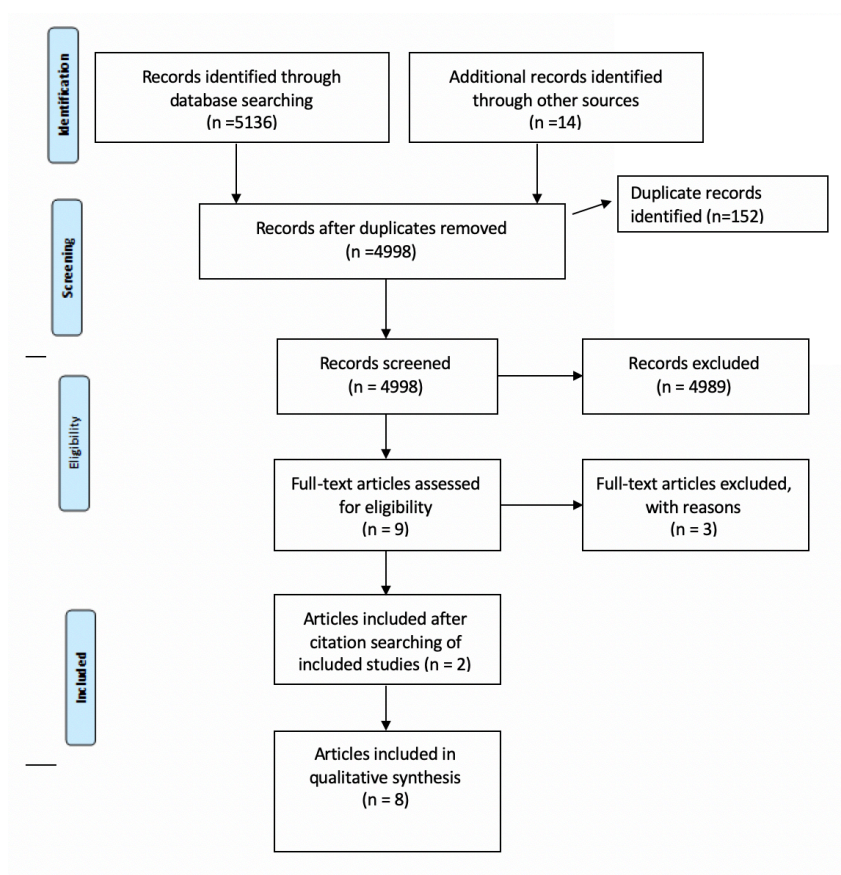
References were downloaded into bibliographic software (Endnote web) and duplicate papers deleted. The papers were screened by DBG for eligibility by screening titles and abstracts followed by the screening of full text, and a final list of included studies was compiled. Data from the relevant studies were extracted into standardized data extraction forms.

## Quality assessment

The articles were critically appraised using 29 quality assessment criteria adapted from NICE [19] by McLean et al [20]. Studies were rated as ++ if they fulfilled 21 or more criteria, as + with 15 to 20 criteria and as – with less than 15 criteria.

Meta-analysis was not planned or done because of the previously known heterogeneity of the methods and measured outcomes of the studies.

## Results



**Figure 1.** Flow chart of included studies (based on the PRISMA flow diagram)

Source- PRISMA 2009 Flow Diagram; Moher et al, 2009 available at [http://www.prisma-statement.org/2.1.4-PRISMA Flow 2009 Diagram.pdf](http://www.prisma-statement.org/2.1.4-PRISMA%20Flow%202009%20Diagram.pdf)

Figure 1 shows that 5150 papers were identified by database searching and from other sources. Duplicate papers (n=152) were removed. Ten papers potentially fulfilled the eligibility criteria. Of these, four were excluded (n=4) because they did not fit the inclusion criteria [Box 1]. Bibliographies of the included six papers were searched and two relevant papers were included, giving eight in total.

Table 2 summarizes the timings, settings and methods of the included papers.

Eight UK based papers 21-28 from four studies - London Life Sciences Prospective Population Study (LOLIPOP), Newcastle Heart Project, Whitehall II Cohort and a survey in Glasgow were included in the review.

The first column shows that the earliest paper was published in 1994 [28] and the latest in 2011 [21].

The second column shows that all the studies were cross-sectional. Five papers were from London [21-24,27] of which four were from a study named LOLIPOP and one from Whitehall 2. Two papers were from the Newcastle Heart Project study, in north-east England [25,26]. One study was in Glasgow [28]. The language of all papers was English. Four papers [22-25] did not comment on the nature of indicators of ethnicity. The third column summarizes the aims of the papers.

**Box 1.** List of excluded studies

1. Perspectives on the Crisis and Challenge of Cardiovascular Disease in the Diverse Asian Populations of California; Colman Ryan MD and Richard E. Shaw PhD; HAWAII MEDICAL JOURNAL, VOL 69, MAY 2010, SUPPLEMENT 2  
-data not available on South Asians.
2. Cardiovascular Stress Responses among Asian Indian and European American Women and Men; Catherine M. Stoney, Ph.D., Joel W. Hughes, Ph.D., Kristin K. Kuntz, B.A., Sheila G. West, Ph.D., and Lisa M. Thornton, B.S. (Ann Behav Med 2002, 24(2): 113-121)- not answering aims and objectives of my study as this study did not compare effects of psychosocial factors between South Asians and the reference population. The purpose of this study was to test the hypothesis that the vasomotor response to stress, as indexed by hemodynamic measures, would be exaggerated in Asian Indian men and women, relative to European American individuals. The results showed that there is a decreased tendency of Asian Indians to vasodilate during psychological stress compared to the reference population.
3. Nadimpalli, S.B., Dulin-Keita, A., Salas, C., Kanaya, A.M. and Kandula, N.R., 2016. Associations between discrimination and cardiovascular health among Asian Indians in the United States. Journal of immigrant and minority health, 18(6), pp.1284-1291.- this study not answering research questions as does not compare the effects of psychosocial factors between South Asians and the reference population.
4. Shah, B.M., Shah, S., Kandula, N.R., Gadgil, M.D. and Kanaya, A.M., 2016. Psychosocial factors associated with subclinical atherosclerosis in South Asians: the MASALA study. Journal of immigrant and minority health, 18(6), pp.1317-1327- this study examines the relationship of psychosocial factors with carotid intima media thickness in the high-risk South Asian population. And hence not answering my research questions as does not compare the effects of psychosocial factors between South Asians and the reference population.

**Table 2.** Summary table of timing, setting, methods and quality scores of the included eight papers

a. First author (reference to bibliography)	a. Location  b. Design of study  c. Indicator of ethnicity	Aim of the study	Key tools used to measure psychosocial factors	a. Age group studied (years)  b. Sample size by ethnic group  c. Response rate	Summary of quality scores
a. Williams R. (28)  b. 1994  c. 1988	a. UK (Glasgow)  b. Cross-sectional  c. Name on the electoral register	The aim of the study is to develop a profile of non-biochemical coronary risks for the South Asian and the general population in Glasgow, with a focus on dietary patterns, and potential causes of stress	Questionnaires prepared for this study	a. 30-40, mean 35  b. South Asians-173 General Population-344  c. 80.5%	+ (study met 20/29 of the quality assessment criteria, and 2 of the unmet criteria were not applicable)
a. Hemingway (27)  b. 2001	a. UK (London)  b. Cross-sectional	To find out whether there were ethnic differences in psychosocial factors which	1. General Health Questionnaire  2. Cook-Medley Hostility Scale	a. 35-55  b. South Asians-577 (Indian 61.6%)	++ (study met 22/29 of the quality assessment criteria, and of 3



c. 1985-2016	Whitehall 2 study  c. Observer at baseline and by self-report at phase 5 follow up	might be consistent with ethnic differences in CHD rate	3. Close persons questionnaire for social support  4. Previously reported measures for psychosocial work characteristics	Whites-8973  c. 73%	the unmet criteria were not applicable)
a. Pollard (26)  b. 2003  c. 1993-1997	a. UK (Newcastle)  b. Cross-sectional Newcastle Heart Study  c. Residents with ancestral origins in India, Pakistan, or Bangladesh and who had at least three grandparents born in those countries	To compare the social networks of South Asian (Indians, Pakistanis and Bangladeshis) and European-origin participants in the Newcastle Heart Project, and to examine the relationships between social network sizes and coronary heart disease (CHD) risk factors in both groups	Questionnaire containing social network questions	a. 25-74  b. South Asians- 684 (Indians 259 Pakistanis 305 Bangladeshis 120) European-825  c. 67% for South Asian and 64% for European people	++ (study met 24/29 of the quality assessment criteria, and 1 of the unmet criteria was not applicable)
a. Fischbacher (25)  b. 2005  c. 1993-1997	a. UK (Newcastle)  b. Cross-sectional Newcastle Heart Study  c. Residents with ancestral origins in India, Pakistan, or Bangladesh and who had at least three grandparents born in those countries	To describe psychosocial work characteristics in the South Asian population and compare it to the European population	Work demand and control were assessed with questions and scales used in the Whitehall study (Bosma et al. 1997), which are based on Karasek's questions	a. 25-74  b. South Asians-261 European-391  c. 67% for South Asian and 64% for European people	++ (study met 25/29 of the quality assessment criteria, and 2 of the unmet criteria were not applicable)
a. Williams E. (24)  b. 2007  c. 2004-2006	a. UK  b. Cross-sectional phase of LOLIPOP study	To compare the exposure to psychosocial factors associated with cardiovascular risk in South Asian men and white European men residing in the UK	1. An adaptation of Pearlin's economic strain scale  2. Neighborhood Problems Scale for 10 potential problems; Social Network Index; Social support was assessed with a scale previously shown to	a. 35-75 years  b. South Asians- 63 (Sikh -52.4% Hindu-19% Muslim-20.6% Christian- 7.9%) White Europeans- 42	++ (study met 23/29 of the quality assessment criteria, and 3 of the unmet criteria were not applicable)

	c. Country of birth and ethnic origin		predict survival in elderly patients following myocardial infarction; Social cohesion was measured using a scale in Chicago  3. Life Orientation Test for optimism; CES-D for Depression	c. 48% (non-responders being predominantly unavailable due to work commitments)	
a. Williams E. (23)  b. 2009  c. 2004-2006	a. UK (London)  b. Cross-sectional phase of LOLIPOP study  c. Country of birth and ethnic origin	To examine the profile of conventional and novel psychosocial risk factors in South Asian compared with white men and women	1. Job strain and effort-reward imbalance models for work stress  2. Perceptions of discrimination scale for racial discrimination; an adaptation of Pearlin's economic strain scale  3. Social support inventory; Social Network Index; MacArthur social support scales  4. Life Orientation Test for optimism; CES-D for depression; Cook-Medley Hostility Scale	a. 35-75 yrs.  b. South Asians-1130 White Europeans-818  c. 83%	++ (study met 26/29 of the quality assessment criteria, and 1 of the unmet criteria was not applicable)
a. Williams E. (22)  b. 2010  c. 2004- 2006	a. UK (London)  b. Cross-sectional phase of LOLIPOP study  c. Not stated in this paper but found in another paper published from the same study <sup>24</sup>	To explore the differences in psychosocial risk factors related to coronary heart disease (CHD) between the different subgroups of South Asians residing in the UK	1. Social support inventory; Social Network Index for social networks; Santa Clara Strength of Religious Faith scale  2. Job strain and effort/reward imbalance models  3. 20-item Center for Epidemiologic Studies of Depression Scale  4. Cook-Medley Hostility Scale	a. 35-75  b. South Asians-1130 (Sikh -50.5% Hindu-28.0% Muslim-15.8%) White Europeans-818  c. 83%	++ (study met 23/29 of the quality assessment criteria, and 4 of the unmet criteria were not applicable)
a. Williams E. (21)  b. 2011  c. 2004-2006	a. UK (London)  b. Cross-sectional phase of LOLIPOP study  c. Not stated in this paper but found in another paper published	Assessing the relationship between hostility and metabolic and autonomic risk factors for CHD in a large population-based sample and testing whether the associations were similar in white and South Asian men and women	Cook-Medley Hostility Scale	a. 35-75 yrs.  b. South Asians-1004 White Europeans-743  c. 45%	++ (study met 24/29 of the quality assessment criteria and 3 of the unmet criteria were not applicable)

	from the same study <sup>24</sup>				
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The fourth column shows that there was variation in the nature and measurement of psychosocial factors limiting the comparisons. Participants self-completed questionnaires or were interviewed. In Williams et al, 2010 [22] and Williams et al, 2009 [23], Pearlin's economic strain scale measured financial stress, the Perceptions of Discrimination scale identified racial discrimination and the Issues checklist scale measured family conflict. In Williams et al, 2007 [24], racial discrimination was assessed with questions from the Fourth National Survey of Ethnic Minorities and neighborhood stress with the Neighborhood Problems Scale.

Depression was measured using the 20-item Center for Epidemiologic Studies of Depression Scale in three papers [22-24]. Hemingway et al used the General Health Questionnaire to measure depression and anxiety [27].

Optimism was assessed with the Life Orientation Test in two papers [23-24].

Psychosocial work stress was explored in five papers [22-25,27]. Work stress was measured using scales used in the Whitehall 2 study in three papers [22-24]. Fischbacher et al [25] assessed work demand and control with a questionnaire based on Karasek's scales.

Hostility was measured using a modified version of the Cook-Medley Hostility Scale in four papers [21-23,27].

Williams et al, 2010 and Williams et al, 2009 [22-23] used the social support inventory and measured negative aspects of social support, social networks and religiosity. In Williams et al, 2007 [24], social networks were measured using the Social Network Index and social cohesion using a scale developed for neighborhood studies in Chicago. Pollard [26] measured the social network with a social network questionnaire. Hemingway [27] used the Close Persons Questionnaire to assess social support.

The fifth column shows that the total sample of the combined studies was 17976 including 5022 South Asians. The number of total participants ranged from 105 [24] to 9910 [27] and for South Asians from 63 [24] to 1130 [22,23]. The participants ranged from 20 and 91 years. The mean age of the participants was between 51-57 years. Seven papers included males and females, one [24] only males. Williams et al, 2010 [22] and Williams et al, 2007 [24] subdivided the South Asian population into Sikhs, Hindus and Muslims. Pollard et al, 2003 [26] subdivided the South Asian population into Indians, Bangladeshis and Pakistanis. The papers compared the South Asians and a predominantly White European (general) population. Six papers, excepting for Williams et al, 2007 [24] and Fischbacher et al, 2005 [25] looked at the duration of residency of South Asians. Williams et al, 2007 [24] and Fischbacher et al, 2005 [25] noted that most South Asians were born outside the UK.

The last column of Table 2 shows the summary quality assessment score of each of the included eight papers. All the studies scored ++ on quality assessment criteria except one [28] which scored +.

### Methods of analysis and results of the studies (Tables 3, 3a, 3b, 4 and 5)

Table 3 provides a summary of the analysis and results of the different psychosocial factors identified across six of the included papers [21,23-26,28]. Two papers [22,27] are not included in Table 3, but are described separately in Tables 4 and 5 as these two papers reported the results in a different way compared to other papers. In one of the papers [22], the South Asian population was divided according to religion and the other paper [27] had reported the combined results for men and women in South Asian and White population.

Tables 3a and 3b provide further analysis of papers already included in Table 3.

Williams et al, 1994 [28] found that South Asian women, compared to the general population had more stress and pressure due to household tasks and yet they did not have any less pleasure and satisfaction with this work. South Asian women were more likely to have been mugged or assaulted than the general population, however, fewer South Asian men were victims of vandalism, mugging and assault than the general population. Fewer South Asian men and women reported feeling they had someone to turn to for support compared to the general population. However, a greater number of South Asian men and women saw their parents or sibling yearly compared to the general population.

Pollard et al, 2003 [26] found that though South Asians had larger families than the reference White European population. South Asian men had less contact with relatives compared to the White Europeans. South Asian men also had limited contact with friends compared to the reference population. South Asian men and women visited places of worship more frequently than the reference population.

Fischbacher et al [25] showed that compared to their European counterpart, more South Asian men had high job control and high decision latitude, but similar proportions had high job demand and fewer South Asians were in high skilled jobs. South Asian people were more likely to be in low demand/high control jobs. However, the patterns varied according to the types of jobs done by the South Asians, the majority of whom were self-employed.

**Table 3.** Summary table of analysis and results of included six papers

a. First author (bibliographic reference)	a. Method of analysis  b. Summary measure for key analysis  c. Key confounders	Psychosocial factors	Male		Statistical significance (95% confidence interval or 'p' value or both)	Female		Statistical significance (95% confidence interval or 'p' value or both)
			White/ General Population	South Asian		White/ General Population	South Asian	
a. Williams R. (28)  b. Stressful conditions and events  c. Not stated	a. 1. Kendall's tau 2. Analysis of variance  b.1. Percentage value (%) 2. 'p' values	Stress/pressure in a day (great amount)	No data	No data	P value not given	4	31	<0.001
		Pleasure/ satisfaction in day (very little)	No data	No data	P value not given	24	17	P value not given
		Ever victim in GB of vandalism	38	25	<0.05	23	24	P value not given
		Ever victim in GB of mugging/assault	19	15	P value not given	7	18	<0.01
		Parent/sibling seen >once daily	3	31	P value not given	4	2	P value not given
		< yearly	4	25	<0.001	6	54	<0.001
		Has someone to turn to	88	78	<0.5	94	79	<0.001
a. Pollard (26) - Newcastle Heart Project  b. Social network factors  c. Age	a. 1. T test 2. Chi-squared test 3. Logistic regression 4. Analysis of variance  b. 1. Percentage (%) 2. 'p' values	Contact with relatives (%)						
		None per month	14	14	P value not given	11	15	P value not given
		1-5 per month	64	75	P value not given	65	62	P value not given
		6+ per month	22	11	P value not given <0.001	24	23	0.30
		Contact with friends (%)						
		None per month	9	2	P value not given	6	10	P value not given
		1-5 per month	49	75	P value not given	61	59	P value not given
		6+ per month	42	23	P value not given <0.001	33	31	0.21
		Attendance at worship (%)						
		Never or rarely	85	17	P value not given	76	50	P value not given

		At least once a month	15	83	<0.001	24	50	<0.001
a. Fischbacher (25) - Newcastle Heart Project	a. Scores divided into tertiles and the top tertile of each score compared with the lower two tertiles	Demand (%) highest tertile	41	42	1 (-9, 11)	44	28	-17 ( -29, - 4)
b. Work demand, decision latitude, skill discretion, job control and social support		Decision (%) highest tertile	26	53	26 (16, 36)	18	44	26 (12, 40)
c. Age	b. 1. Percentage (%) 2. Difference in proportion (95% CI) of South Asians and Europeans	Skill (%) highest tertile	52	31	-21 (-31, - 11)	37	40	2 (-12, 17)
		Control (%) highest tertile	35	42	7 (-3, 17)	23	33	10 (-5, 25)
a. Williams (24) - LOLIPOP study	a. 1. t test	Job control (0-100) (low-high) [mean (SD)]	83.2 (16.6)	69.7 (19.1)	(p =0.004)	No data	No data	No data
b. Psychosocial factors (chronic stress, protective factors in the social environment and psychological factors)	2.Non-parametric statistics b. 1. Mean value (+/- standard deviation or standard error values)	Job demands (0-100) (low-high) [mean SD]	70.2 (16.4)	65.1 (15.2)	P value not given			
c. None (reason stated)	2. Percentage (%)	Financial strain (0-100) (low-high) [mean (SD)]	45.7 (7.3)	53.3 (15.2)	(p =0.004)			
		Neighborhood cohesion (0-100) (low-high) [mean (SD)]	69.0 (15.0)	61.1 (18.0)	(p =0.021)			
		Perceived discrimination in the workplace (%)	11.4	35.0	(p =0.029)			
		Emotional support (no support) (%)	11.9	27.0	(p=0.023)			
		Depression (CES-D, 0-60) [mean (SD)]	6.5 (5.1)	12.5 (10.7)	(p<0.001)			

		Optimism (0–24) [mean (SD)]	15.8 (2.5)	13.7 (2.7)	(p<0.001)			
a. Williams (23) - LOLIPOP study	a. 1. Analyses of covariance 2. Chi-square test	Financial strain (mean [SD or SE])	2.9 (0.16)	3.8 (0.14)	(p< 0.001)	3.2 (0.28)	4.1 (0.21)	(p< 0.05)
b. Psychosocial factors (financial strain, family conflict, job control, depression)	b. 1. Mean value (+/- standard deviation or standard error values) 2. Percentage (%)	Family conflict (mean [SD or SE])	8.6 (0.50)	10.9 (0.39)	(p< 0.001)	10.2 (1.00)	14.2 (0.58)	(p< 0.001)
c. Age, socioeconomic status		Job control (0-100) (mean [SD or SE])	54.6 (1.35)	48.3 (1.15)	(p< 0.001)	41.0 (1.91)	49.5 (1.56)	P value not given
		Depression (mean [SD or SE])	11.7 (0.39)	14.5 (0.35)	(p< 0.001)	12.8 (0.73)	16.2 (0.57)	(p< 0.001)
		Job strain (0-100) (mean [SD or SE])	1.19 (0.12)	1.34 (0.10)	P value not given	1.11 (0.11)	0.92 (0.09)	P value not given
		Effort–reward imbalance (0-100) (mean [SD or SE])	1.63 (0.08)	1.74 (0.07)	P value not given	1.23 (0.13)	1.55 (0.11)	P value not given
		Work support (0-100) (mean [SD or SE])	57.0 (1.26)	45.4 (1.06)	(p< 0.001)	32.8 (1.79)	33.7 (1.44)	P value not given
a. Williams (21) - LOLIPOP study	a. 1. Logistic regression analysis 2. Linear regression analysis	Hostility (mean [SD])	12.1(5.30)	13.6 (5.01)	(p<0.001)	9.6 (5.06)	13.4 (5.37)	(p<0.001)
b. Hostility	b. Mean values (standard deviations)							
c. Age, education, smoking, physical activity, BMI, and WHR								

Williams et al, 2007 [24] provided data for men only and showed that the South Asian men had lower control in their jobs compared to the White European population, but the ethnic groups did not differ with regard to job demands. South Asians experienced higher financial strain and lower neighborhood cohesion. The greater percentage of South Asians were discriminated by their employers on racial grounds. South Asians had less emotional support and were more depressed and less optimistic than the White Europeans.

Williams et al, 2009 [23] reported that South Asians experienced more financial strain, more family conflict, less job control (for South Asian men only and not South Asian women) and more depression. These effects were largely independent of socioeconomic status. The study also demonstrated that there was no statistically significant difference in the level of job strain and effort-reward imbalance between the different ethnic groups but social support at work was noted to be more in the general population than the South Asian population.

Williams et al, 2011 [21] showed that the South Asian population had a statistically significant increased level of hostility in comparison to the White Europeans.

Tables 3a and 3b show subgroup analysis by religion and by place of ancestral origin. Table 3a shows the analysis of psychosocial factors in Fischbacher et al [25] by religion namely Muslims and Non-Muslims. Only non-Muslim people were more likely to have high job control and high decision latitude in comparison to Europeans.

Table 3b shows that Pollard [26] shows analysis by country of ancestral origin namely India, Pakistan and Bangladesh. There were no significant differences amongst the men of the three ancestral groups in frequency of contact with friends or relatives, but there were significant differences for women in contact with a friend. There was a difference in the subgroups regarding attendance at worship and Pakistani and Bangladeshi men attended worship more frequently than Indian men. Indian women attended worship more frequently than Pakistani and Bangladeshi women.

Table 4 shows a summary of the analysis and results of the different psychosocial factors among the different religious subgroups in the South Asian population in Williams et al [22] compared with the reference population. The differences in work stress, emotional support, family conflict, depression and hostility between religious subgroups were not statistically significant.

Table 5 shows that Hemingway et al, 2001 [27] did not find any statistically significant differences in anxiety between ethnic groups. South Asians had more depression, higher negative support, less emotional support, more social support at work, less job control, higher effort-reward imbalance and higher hostility than the white population.

**Table 3a.** Analysis of psychosocial factors in Fischbacher et al [25] according to the subgroup of South Asian population by religion namely Muslims and Non-Muslims

Psychosocial factors by stress	Non-Muslim	Difference (95% CI), p value Between Europeans and Non-Muslims	Muslim	Difference (95% CI), p value Between Europeans and Muslims
<b>Male</b>				
Demand (%) (highest tertile)	44	3 (11, 16)	41	0 (12, 12)
Decision (%) (highest tertile)	61	34 (21, 48)	47	20 (9, 32)
Skill (%) (highest tertile)	41	10 (24, 3) (p<0.0001)	25	27 (16, 38) (p=0.14)
Control (%) (highest tertile)	55	19 (5, 33) (p=0.006)	35	-1 (12, 11)
<b>Female</b>				
Demand (%) (highest tertile)	23	21 (35,8)	40	- 4 (30, 22)
Decision (%) (highest tertile)	45	27 (11,43)	36	18 ( 8, 43)
Skill (%) (highest tertile)	38	0 (15, 16)	50	13 (16, 42)
Control (%) (highest tertile)	33	11 (-5, 27)	22	0 (28, 28)

**Table 3b.** Subgroup analysis of psychosocial factors in Pollard et al [26] according to the country of ancestral origin

Males					Females				Overall ethnic group difference
	I*	P*	B*	p value	I*	P*	B*	p value	p value
Contact with relatives (%)				ns				0.05	ns
None per month	15	15	8		15	17	10		
1-5 per month	74	75	78		58	59	62		
6+ per month	11	10	14		27	24	23		
Contact with friends (%)				ns				0.02	0.05
None per month	3	3	2		10	11	4		
1-5 per month	72	77	73		53	58	80		
6+ per month	25	20	25		37	31	16		
Attendance at worship (%)				< 0.001				< 0.001	<0.001
Never or rarely	29	13	8		18	71	82		
At least once a month	71	87	92		82	29	18		
I*-Indians P*-Pakistanis B*-Bangladeshis ns-not statistically significant									

### Rationale for a narrative systematic review

The tables demonstrate considerable heterogeneity across the studies in quality assessment, methods and psychosocial measures. Hence, the meta-analysis of the included studies was not deemed appropriate.

**Table 4.** Subgroup differences in psychosocial factors relating to coronary heart disease in the UK South Asian population in William et al [22] according to religion

a. First author (bibliographic reference)	a. Method of analysis  b. Summary measure for key analysis	Psychosocial factors	Sikhs	Muslims	Hindus	General population
b. Key risk factors						
c. Key confounders						
a. Williams et al (22)	a.	Financial strain (mean[95%CI])	3.54 (3.2–3.9) (p<0.5)	5.06 (4.5–5.6) (p< 0.001)	3.90 (3.5–4.3) (p<0.5)	3.01 (2.7–3.3) (p< 0.001)
b. Chronic stressors (overcrowding, discrimination, work stress, financial strain)	1. Analysis of covariance 2. Fischers least significance difference tests	Social cohesion (mean[95%CI])	60.8 (59.2–62.4) (p<0.5)	56.2 (53.4–59.1) (p= 0.013)	58.4 (56.2–60.5) (p<0.5)	62.2 (60.8–63.5) (p<0.5)
c. Age, sex, socioeconomic position	b.	Perceived racial discrimination (% [95% CI])	38.1 (34.5–41.7) (p= 0.034)	39.2 (32.6–45.8) (p= 0.034)	28.6 (23.7–33.4)	Not applicable
	1. Mean values (95% confidence intervals) 2. Percentage (%) (95% confidence intervals)	Social network (mean[95%CI])	5.56 (5.4– 5.7) (p = 0.024)	5.11 (4.8–5.4) (p<0.5)	5.25 (5.0–5.5) (p<0.5)	5.02 (4.9–5.1) (p<0.5)



**Table 5.** Analysis of psychosocial factors in Hemingway et al [27] combining men and women in South Asians and White population

a. First author (Bibliographic reference)	a. Method of analysis  b. Summary measure for key analysis	Psychosocial factors	White/general population men and women combined	South Asian men and women combined	Statistical significance (p value)
b. Key risk factors					
c. Key confounders					
a. Hemingway (27)	a.	Depression	1.0	1.38 (1.1-1.7)	0.001
	1. Direct standardization	Anxiety	1.0	0.86 (0.7-1.1)	0.18
		Negative support	1.0	2.61 (2.1-3.3)	0.0001
b. Minor psychiatric morbidity (GHQ), social supports, work psychosocial characteristics	2. Logistic regression	Emotional support	1.0	0.71 (0.5-0.9)	0.07
		Social support at work	1.0	1.17 (1.0-1.4)	0.12
	b. OR (95%CI)	Control at work	1.0	0.82 (0.7-1.0)	0.06
		Effort reward imbalance	1.0	1.33 (1.1-1.7)	0.01
c. Age, sex and employment		Hostility	1.0	2.58 (2.0-3.4)	0.0001

## Discussion

### Principal findings

Our principal finding is that given the potential importance of the subject there is a serious shortage of published data. This needs to be remedied. The results indicate that South Asians had higher levels of psychosocial risk factors than the reference population which is noted below. The question of whether the association with health outcomes was similar could not be answered for the lack of prospective studies with relevant outcomes.

Apart from one paper [25] all others established higher psychosocial risk factors in South Asians residing in the UK.

One paper [22] established that a greater number of Muslims were subject to poor socioeconomic circumstances, with respect to homeownership, income and social deprivation. From these papers, it could be noted that Muslims were in a disadvantageous position in comparison to Hindus and Sikhs with respect to psychosocial factors, but not with respect to social relationships. Since the review suggest that Muslims were more exposed to psychosocial adversities in comparison to Sikhs and Hindus, hence the conclusions also apply to the different subsets of the South Asian population.

One paper [25] concluded that there was no statistically significant difference between the overall balance of job demand and control in South Asian and European people and increased work strain does not contribute to the increased risk of CHD in UK South Asian people. However, another paper [27] showed some evidence of more psychosocial stress among the South Asians in the Whitehall 2 study [27]. The authors found that South Asians had greater effort/reward imbalance and less job control, greater depression and hostility compared to the reference population. Fischbacher postulated that the difference in psychosocial work characteristics between the findings of Hemingway et al [27] and Fischbacher et al [25] were due to the difference in the category of occupation of the respondents. The first one collected data from civil servants while Fischbacher included participants from a broader range of occupations in their study.

### Strengths and limitations

The strengths included that studies were assessed for methodological quality; grey literature was included to minimize publication bias [30]. Reporting followed the recommendations of the Centre for Reviews and Dissemination (CRD) [31] and the PRISMA guidelines [32]. This review imposed no restrictions on the publication year or language. A rigorous search process was applied. The databases were searched at the beginning of the review and repeated to identify up-to-date relevant papers. In this review, several psychosocial factors

were identified. The risk factors were measured by validated questionnaires in the included papers, providing information regarding a spectrum of psychosocial factors. Williams [21-23] and Fischbacher [25] tested the used checklists and scales for internal scale consistency (Cronbach's alpha score) thus ensuring the reliability of the measurements.

The limitations include the possibility of publication bias, although we have tried to address this by searching grey literature. The literature was sparse, wholly from the UK, mostly from London and only from four separate studies. There is also a possibility of bias concerning the methods involved. The search was conducted solely by DBG as the work started as a Master of Public Health (MPH) project, for which autonomous working under regular supervision by RSB was a requirement. There were 5150 articles retrieved initially from the search results, the fact that this has been screened by one individual could have led to bias. Furthermore, the extracted data in the tables were double-checked by RSB, to help minimize errors.

All the studies in the review are cross-sectional in design; none of the studies are prospective studies or randomized controlled trials. Future prospective studies are needed to further explore the association since it is difficult to determine if the psychosocial factors described preceded the coronary heart disease event in the included studies. These cross-sectional studies need to be interpreted with caution [22]. The methods of assessment of psychosocial factors across the papers lacked standardization. This compromises the ability to compare findings across studies.

The language of all the included papers was English, although there was no restriction on language in the inclusion criteria. This fact signifies a lack of research in this field in non-English speaking countries.

A number of measurement tools were not validated specifically for the South Asian population like the Karassik questionnaire used by Fischbacher [25]. It had been tested with the White European and North American populations but not in South Asian samples [25].

### Comparison with other studies

Several researchers had conducted literature reviews [8,16,17,34] in the past investigating the link between psychosocial factors and CHD and have established a positive correlation between stress [17], social support [17,34]; work-related psychosocial factors [16,34]; depression [34] and etiology and prognosis of CHD. A very recent meta-analysis had established a modest association between job insecurity and IHD risk [35]. Previous reviews were conducted in the UK and America but did not specify the ethnicities studied.

It seems reasonable to assume that in the South Asian population there is an association between psychosocial factors and CHD based on the previous INTERHEART study [12,29].

In the context of incidence of CHD and its associated mortality, Bangladeshis are in the highest unfavorable position followed by Pakistanis and Indians [35]. The subgroup analysis in the current review showed that Muslims were in a disadvantageous position in comparison to Hindus and Sikhs with respect to psychosocial factors, but not with respect to social relationships. It would be important to explore in future research whether the above sub-group findings could be related to the high burden of CHD in the Muslim population [2].

### Implications for research

These papers show that South Asians are subjected to higher work stress, but no research has focused on stress due to the threat of job loss. Further research exploring job insecurities in the South Asians are essential as evidence shows job insecurity act as risk factors of CHD [36].

This review has included relevant papers from the UK only, despite broader geographical inclusion criteria. No research was available for the rest of Europe or North America either in English or other languages. Previous reviews have shown a scarcity of research data in non-White populations in Europe [37]. More research should be directed towards the South Asian population residing in other parts of the UK, the rest of Europe and indeed on the Indian subcontinent.

### Conclusion

There is some evidence of a higher prevalence of psychosocial factors in South Asians than in reference populations. Studies should be planned to explore the prospective associations between such risk factors and health outcomes.

### Conflict of interest

The authors declare that they have no competing interests with regards to authorship and/or publication of this paper.

### Funding

There was no funding received for this article.

## References

1. Bhopal RS. Migration, ethnicity, race and health in multicultural societies: Oxford University Press; 2014.
2. Wild SH, Fischbacher C, Brock A, Griffiths C, Bhopal R. Mortality from all causes and circulatory disease by country of birth in England and Wales 2001–2003. *J Public Health (Oxf)* 2007;29:191-8.
3. Baine KR, Jugdutt BI. Increased burden of coronary artery disease in South-Asians living in North America. Need for an aggressive management algorithm. *Atherosclerosis* 2009;204:1-10.
4. Forouhi N, Sattar N, Tillin T, McKeigue P, Chaturvedi N. Do known risk factors explain the higher coronary heart disease mortality in South Asian compared with European men? Prospective follow-up of the Southall and Brent studies, UK. *Diabetologia* 2006;49:2580-8.
5. Nicholson A, Kuper H, Hemingway H. Depression as an aetiological and prognostic factor in coronary heart disease: a meta-analysis of 6362 events among 146 538 participants in 54 observational studies. *Eur Heart J* 2006;27:2763-74.
6. Bosma H, Marmot MG, Hemingway H, Nicholson AC, Brunner E, Stansfeld SA. Low job control and risk of coronary heart disease in Whitehall II (prospective cohort) study. *BMJ* 1997;314:558.
7. Karasek Jr RA. Job demands, job decision latitude, and mental strain: Implications for job redesign. *Administrative Science Quarterly* 1979;285-308.
8. Hemingway H, Marmot M. Psychosocial factors in the aetiology and prognosis of coronary heart disease: systematic review of prospective cohort studies. *BMJ* 1999;318:1460-7.
9. Buselli EF, Stuart EM. Influence of psychosocial factors and biopsychosocial interventions on outcomes after myocardial infarction. *J Cardiovasc Nurs* 1999;13:60-72.
10. Rozanski A, Blumenthal JA, Kaplan J. Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation* 1999;99:2192-217.
11. Rozanski A, Blumenthal JA, Davidson KW, Saab PG, Kubzansky L. The epidemiology, pathophysiology, and management of psychosocial risk factors in cardiac practice: the emerging field of behavioural cardiology. *J Am Coll Cardiol* 2005;45:637-51.
12. Rosengren A, Hawken S, Ôunpuu S, Sliwa K, Zubaid M, Almahmeed WA, et al. Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): case-control study. *Lancet* 2004;364:953-62.
13. Joshi P, Islam S, Pais P, Reddy S, Dorairaj P, Kazmi K, et al. Risk factors for early myocardial infarction in South Asians compared with individuals in other countries. *JAMA* 2007;297:286-94.
14. Fox KM, Shapiro LM. Heart disease in Asians in Britain. *BMJ* 1988;297:311.
15. Backé EM, Seidler A, Latza U, Rosnagel K, Schumann B. The role of psychosocial stress at work for the development of cardiovascular diseases: a systematic review. *Int Arch Occup Environ Health* 2012;85:67-79.
16. Greenwood DC, Muir KR, Packham CJ, Madeley RJ. Coronary heart disease: a review of the role of psychosocial stress and social support. *J Public Health Med* 1996;18:221-31.
17. Clarke C, Peach C, Vertovec S. South Asians overseas: migration and ethnicity. Cambridge University Press; 1990.
18. Higgins JP, Green S. Cochrane handbook for systematic reviews of interventions. John Wiley & Sons; 2011.
19. Kelly M, Morgan A, Ellis S, Younger T, Huntley J, Swann C. Evidence based public health: a review of the experience of the National Institute of Health and Clinical Excellence (NICE) of developing public health guidance in England. *Soc Sci Med* 2010;71:1056-62.
20. McLean J, Maxwell M, Platt S, Harris FM, Jepson R. Risk and protective factors for suicide and suicidal behaviour: A literature review. Scottish Government; 2008.
21. Williams ED, Steptoe A, Chambers JC, Kooner JS. Ethnic and gender differences in the relationship between hostility and metabolic and autonomic risk factors for coronary heart disease. *Psychosom Med* 2011;73:53-8.
22. Williams ED, Nazroo JY, Kooner JS, Steptoe A. Subgroup differences in psychosocial factors relating to coronary heart disease in the UK South Asian population. *J Psychosom Res* 2010;69:379-87.
23. Williams ED, Steptoe A, Chambers JC, Kooner JS. Psychosocial risk factors for coronary heart disease in UK South Asian men and women. *J Epidemiol Community Health* 2009;63:986-91.
24. Williams ED, Kooner I, Steptoe A, Kooner JS. Psychosocial factors related to cardiovascular disease risk in UK South Asian men: a preliminary study. *Br J Health Psychol* 2007;12:559-70.
25. Fischbacher CM, White M, Bhopal RS, Unwin NC. Self-reported work strain is lower in South Asian than European people: Cross-sectional survey. *Ethn Health* 2005;10:279-92.
26. Pollard TM, Carlin LE, Bhopal R, Unwin N, White M, Fischbacher C. Social networks and coronary heart disease risk factors in South Asians and Europeans in the UK. *Ethn Health* 2003;8:263-75.
27. Hemingway H, Whitty C, Shipley M, Stansfeld M, Brunner E, Fuhrer R, et al. Psychosocial risk factors for coronary disease in White, South Asian and Afro-Caribbean civil servants: the Whitehall II study. *Ethn Dis* 2001;11:391-400.
28. Williams R, Bhopal R, Hunt K. Coronary risk in a British Punjabi population: comparative profile of non-biochemical factors. *Int J Epidemiol* 1994;23:28-37.
29. Yusuf S, Hawken S, Ôunpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004;364:937-52.
30. Joobar R, Schmitz N, Annable L, Boksa P. Publication bias: what are the challenges, and can they be overcome? *J Psychiatry Neurosci* 2012;37:149-152.

31. University of York. Centre for Reviews and Dissemination. Systematic reviews: CRD's guidance for undertaking reviews in health care. York: University of York NHS Centre for Reviews & Dissemination; 2009.
32. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JP, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med* 2009;6:e1000100.
33. Bailey L, Vardoulaki K, Langham J, Chandramohan D. Introduction to epidemiology: Open University Press London; 2005.
34. Kuper H, Marmot M, Hemingway H. Systematic review of prospective cohort studies of psychosocial factors in the etiology and prognosis of coronary heart disease. *Semin Vasc Med* 2002;2:267-314.
35. Bhopal R, Unwin N, White M, Yallop J, Walker L, Alberti K, et al. Heterogeneity of coronary heart disease risk factors in Indian, Pakistani, Bangladeshi, and European origin populations: cross sectional study. *BMJ* 1999;319:215-20.
36. Virtanen M, Nyberg ST, Batty GD, Jokela M, Heikkilä K, Franssön EI, et al. Perceived job insecurity as a risk factor for incident coronary heart disease: systematic review and meta-analysis. *BMJ* 2013;347:f4746.
37. Ranganathan M, Bhopal R. Exclusion and inclusion of non-White ethnic minority groups in 72 North American and European cardiovascular cohort studies. *PLoS Med* 2006;3:e44.